"Richer! Deeper! Broader!
Going for the Gold in Math Questioning"

INTRODUCTION

Our team identified a need in our teaching practice for deep and rich problem-based math questions that develop understanding and higher order thinking in our students. Our project was to develop a continuum from kindergarten to grade 3 of rich, problem-based math questions. We reviewed available research and literature, and created questions which we field-tested in our classrooms. Questions were then evaluated as to their effectiveness. Through much discussion over several months, we developed questions that were open-ended and differentiated in order to have all students participate. Over the course of this project, we gained a more thorough understanding of problem-based questioning, became more cognizant of the big ideas in mathematics across the 4 grade levels, and acquired a more thorough understanding of the mathematics curriculum.

Our Philosophy

Part of our philosophy is that students need to learn to choose appropriate materials/tools to work through the problems. Classrooms need to have manipulatives, and math tools available to students at all times. Teachers are encouraged to avoid directing students to answer problems in a certain way by just taking out the unifix cubes, for example. Suggested manipulatives/tools are: rulers, meter sticks, cloth rulers, calculators, 100 charts, 10 frames, thermometers, pattern blocks, buttons, money, counters, geometric solids, colour tiles, clocks, attribute blocks, geoboards, base ten blocks, just to name a few.

From our experiences, we've learned that students will be excited and open up to doing problem-solving when the problems are appealing and interesting to them. When writing the problems, our choices of topics came out of experiences with our own students and our knowledge of what's important to them. Each teacher knows his or her class well and is encouraged to tweak the problems as needed. Also, please note that some of the problems can be done during one class period, while others will grow into projects that last much longer. For example, all primary classes could be working on the lunch kit project.

How should students record their thinking on paper? In our experience, it is helpful to teach students a school-based written format for recording their thinking when problem-solving. Our students record their thinking on 12 by 18 inch blank newsprint. This gives lots of room for showing their work and is great for sharing later in front of the class.
The expectation is that students include the following in their written responses.

REMEMBER: when you have a problem, apply ICE!

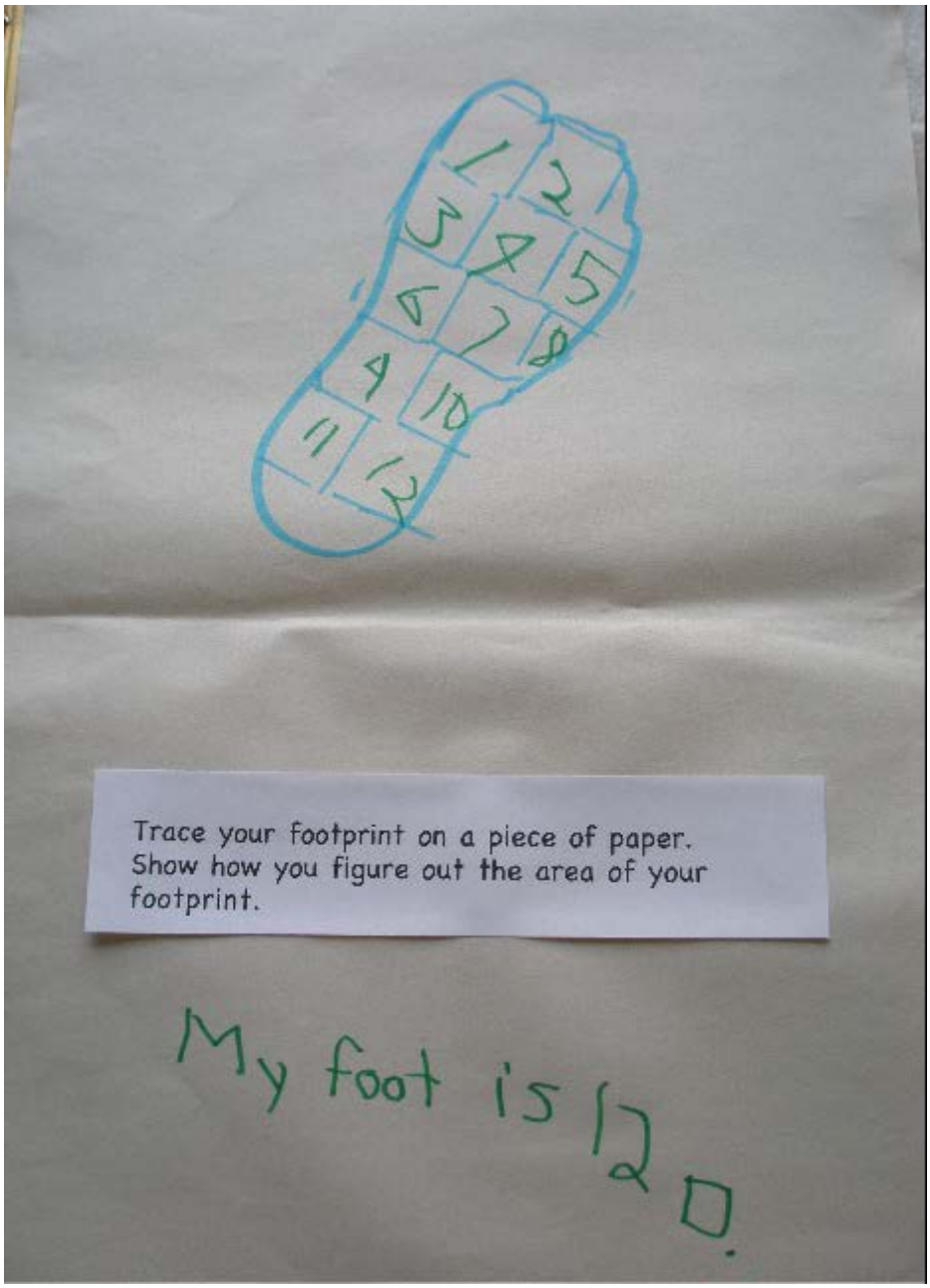
Illustrate (pictures)
Calculate (numbers)
Explain (use words to persuade)

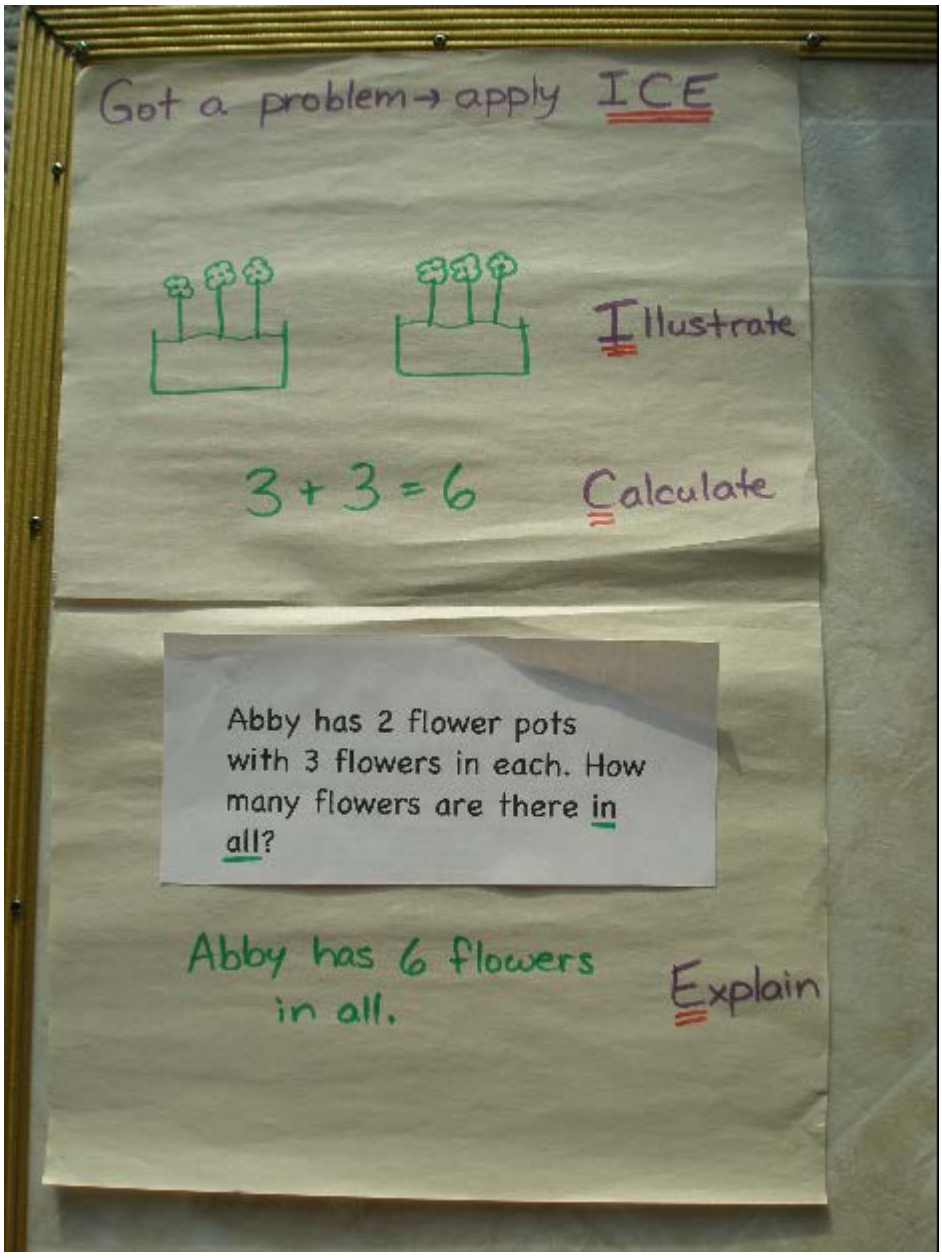
We've learned that by using markers, students can't erase what they've worked through. Their thinking becomes obvious to others and gives teachers information on what has been understood and what still needs to be taught. Students also quickly learn that risk taking and making mistakes are all a part of problem-solving and very acceptable.

Illustrate and Calculate here.

Trace your footprint above. Show how you might figure out the area of your footprint.

Explain in words here


Trace your footprint on a piece of paper.
Show how you figure out the area of your footprint.
My foot is 120.


Got a problem → apply ICE
Illustrate
3 + 3 = 6
Calculate
Abby has 2 flower pots with 3 flowers in each. How many flowers are there in all?
Abby has 6 flowers in all.
Explain

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